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## FINAL REPORT

**Grant Title:**  $\beta$ -Barium Borate Optical Parametric Oscillator

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**Dollar Amount:** \$50,000

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**Final Report submitted to NRL**  
**on**  
 **$\beta$ -Barium Borate Optical Parametric Oscillator**

A  $\beta$ -Barium Borate Optical Parametric Oscillator (BBO OPO) has been constructed and shipped to the Army laboratory at White Sands. This OPO is a truly continuously tunable source with a very large spectral coverage. It is pumped at the third harmonic of Nd:YAG or 335 nm. The output is continuously tunable over the entire spectral range from 450 nm to 2.5  $\mu$ m with relatively high efficiency. The tuning is completely computer controlled. Photographs of two such BBO OPOs are shown in Figure 1. One of these was shipped to the Army. The other one now remains in our laboratory for further work on reducing the linewidth of the output.

The basic design of the oscillator is shown in Figure 2. The two-crystal configuration was needed to compensate for the walk-off in BBO. The intracavity pump beam steering mirrors are needed to reduce the chance of uv damage of the resonator mirrors. The efficiency of the OPO is over 30%. The linewidth of the oscillator without using special line narrowing scheme is relatively large, however (Figure 3). There are special line narrowing schemes that can be employed to significantly reduce the linewidth at with some sacrifice in the threshold for oscillation and efficiencies. An alternative is to use Type II phase-matching, by which a line width on the order of an Angstrom can be maintained throughout the tuning range (Figure 3) without additional line narrowing elements in the oscillator cavity. Work is under way to incorporate some sort of line narrowing mechanism in the OPO.



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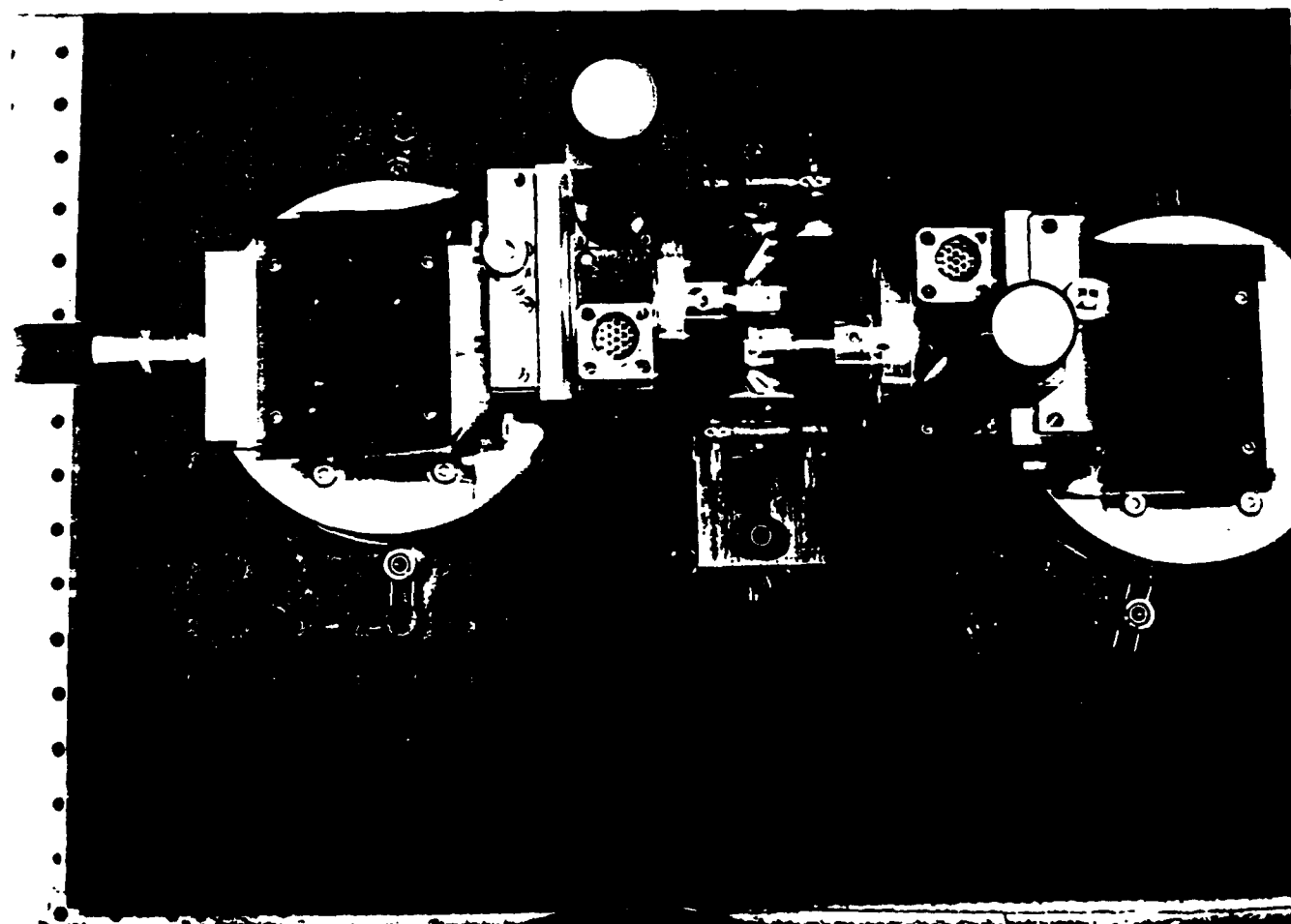
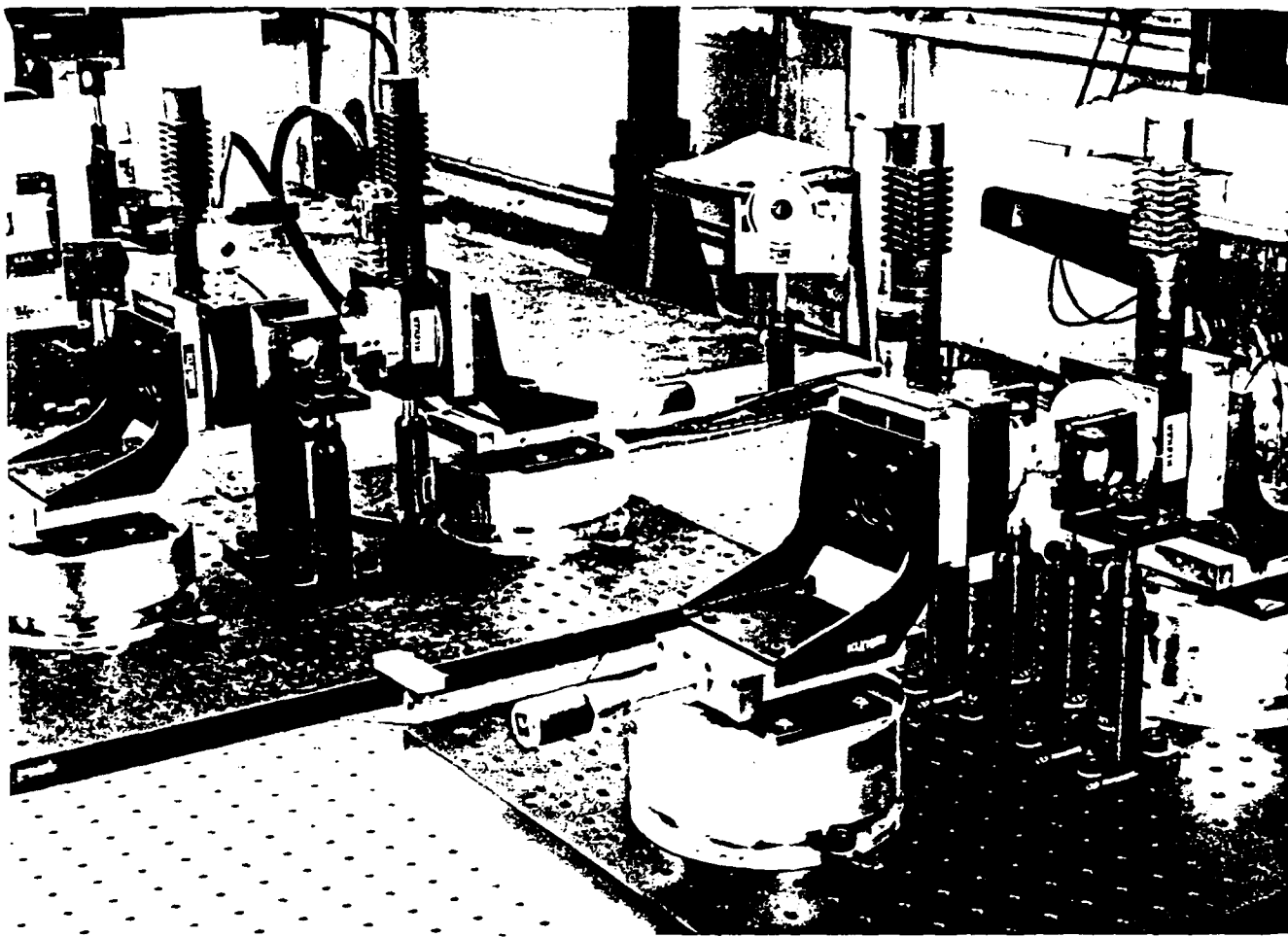
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## Figure Captions

**Figure 1** - Photographs of BBO OPOs (2). Top: Side view. Bottom: To view.

**Figure 2** - Schematic of walk-off compensated two-crystal configuration of BBO OPO with intracavity beam-steering mirrors.

**Figure 3** - Line width vs. signal wavelength for Type I and Type II walk-off compensated BBO OPOs pumped at 354.7 nm.



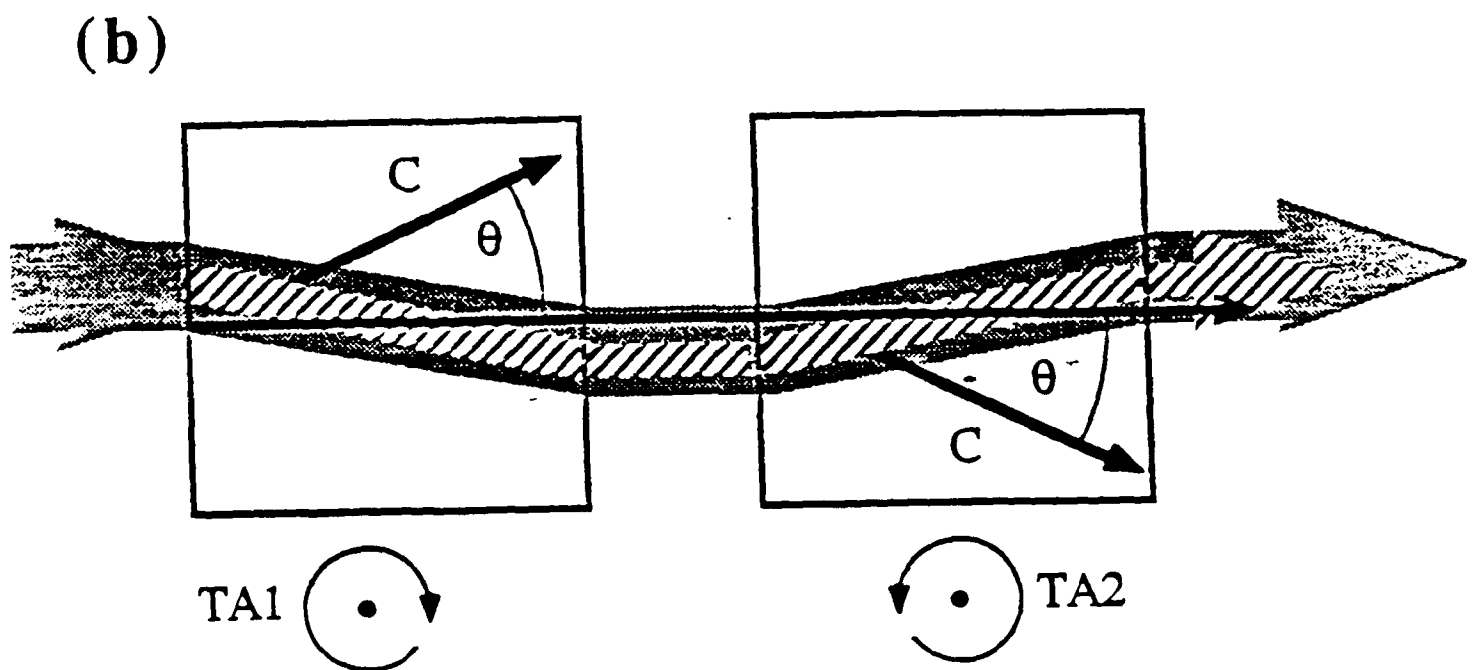
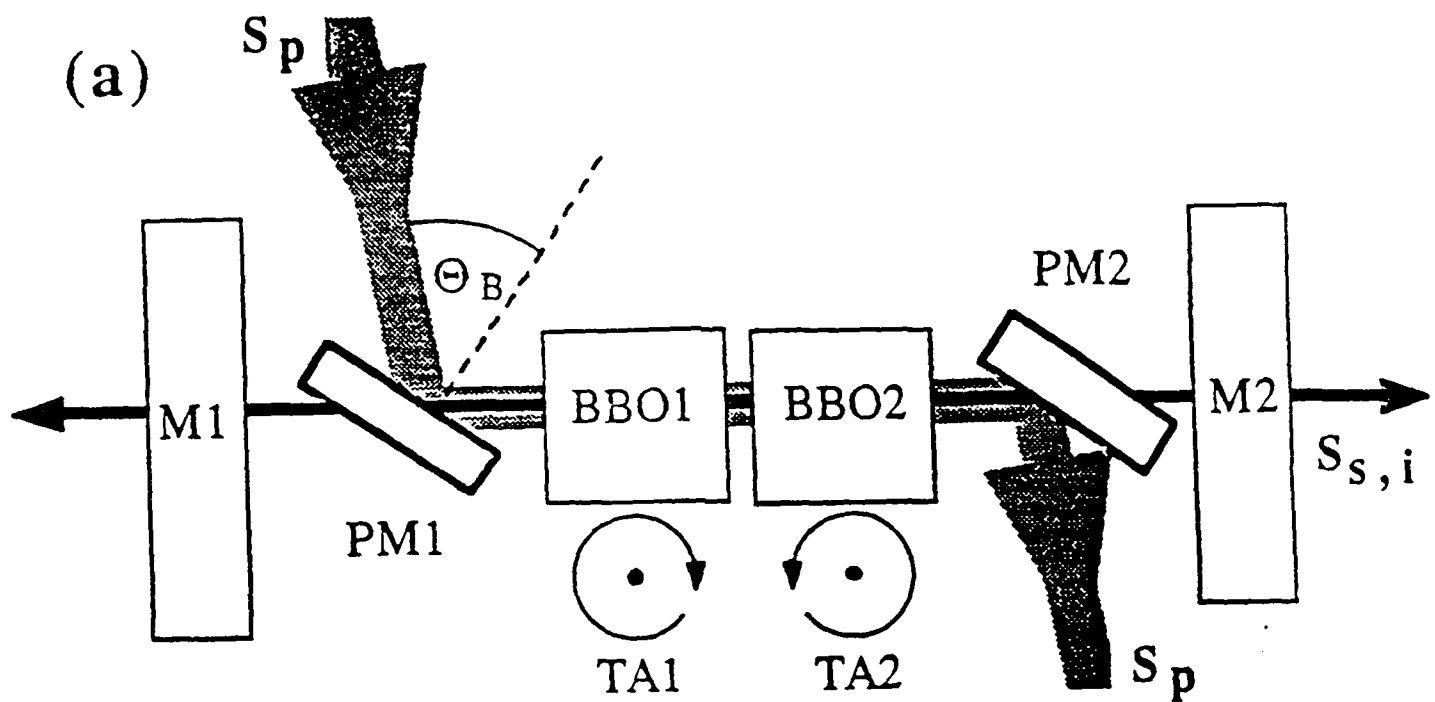


Figure 2

